Appendix

ON PACKET P ARRIVING $queue_i$ OF $source_i$
1   enqueue(p, $queue_i$);
2   /* $\widehat{A}$ is set of active traffic sources */
3   If $i \notin \widehat{A}$
4           $\widehat{A} = \widehat{A} - \{i\}$;
5           $start\_tag_i = virtual\_time$;
6           $finish\_tag_i = start\_tag_i$
7                   $+ sum_{i \in A}(r_i)/r_i * size(p)/speed_i$;
8           $credit_i = 0$;

EXTRACTING PACKET FOR TRANSMITTING
1    $l = min_{start\_tag_k}(k \in A)$;
2   If $credit_l <= 0$ /* handling non-leading flows */
3   If (l can send)
4   PKT_SEND(l, l)
5   else
6   /* l cannot send due to channel error */
7   /* find flow with smallest start_tag to substitute i */
8                   $g = min_{start\_tag_k}(k \in \widehat{A}, k\_can\_send)$
9   if (g exists)
10   /* transmit for g, update tags,credit for both */
11   PKT_SEND(g, l);
12   else   /* All sources are in channel error */
13   IDLE;
14   else /* handling leading flows */
15   /* decide whether let leading flow transmit or compensate */
16   flag = compensation_flag(l); /* 1: compensate, 0: normal */
17          $g = min_{comp\_tag}(k | k \in A, credit_k < 0, k\_can\_send)$;
18   if (l_can_send)and((!flag)or((flag)and(g !exists))
19   PKT_SEND(l, l);
20   else If (g exists)
21   PKT_SEND(g, l);
22   else /* All sources are in channel error */
23   IDLE;
24   /* check if some flow becomes inactive */
25   /* adjust other flows in A accordingly */
26   HANDLE_IDLE_FLOW;

PKT_SEND(g, l)
/* send packet from $source_i$, update tags, credits for both */
1    $p_l = $ dequeue(l);
2   /* update start and finish tag only for l */
3    $start\_tag_l = max(virtual\_time, finish\_tag_l)$;
4    $finish\_tag_l = start\_tag_l + sum_{i \in A}(r_i)/r_l * size(p_g)/speed_l$;
5   if($l \neq g$)
6           $credit_l += size(p_g)/speed_l$;
7           $credit_g -= size(p_g)/speed_l$;
8           $comp\_tag_l = -size(p_g)/(speed_l * credit_l)$;
9           $comp\_tag_g = -size(p_g)/(speed_g * credit_g)$;

HANDLE_IDLE_FLOW(j, i)
/* adjust flows credit counters once some flow becomes inactive */
1    $\widehat{A} = \widehat{A} - \{i\}$
2   if $\exists i, s.t. empty(queue_i)$
3   for ($k \in \widehat{A}$)
4                   $credit_k = credit_k + credit_i * r_i/sum_{k \in A}(r_j)$;

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